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TECHNICAL REPORT

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# **SURVEY OF NONCARBONATED FRUIT JUICES AND FRUIT-FLAVORED BEVERAGES**

by

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Project reference: 728012.12

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October 1972

**UNITED STATES ARMY  
NATICK LABORATORIES  
Natick, Massachusetts 01760**



**Food Laboratory**

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<p>This study was initiated by a request to feed "volunteer" military services foods that are not only nutritious but acceptable. Specifically, beverages were singled out since they constitute products of processed fruit juices and fruit-flavored beverages of which there are over 100 different types at the marketplace. In order to clarify and attempt to reduce costs of military procurement this report lists beverages classified according to their product types, their range in cost per 6 fluid oz. serving, and other data that describe the product such as its nutritional characteristics and the like.</p> <p>Since the services buy beverages based on a degree of conscious definition and planning of the entire dietary (in terms of nutritional content, acceptability, shelf life, utility and costs) this study was directed to serve as background information written in non-technical or semi-technical terms for use by planners or anyone else involved in procurement.</p> <p>The study accordingly proceeded largely on the basis of a survey of over 100 different products offered by three representative supermarkets in the Greater Boston area. Data on product characteristics, available federal standards, nutritional aspects, flavor, cost and additives were obtained for these items, which were classified into five distinct groups: fresh juices, frozen concentrates, canned and bottled beverages, beverage base powders and liquid beverage base concentrates.</p>		

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JUICES AND FRUIT-FLAVORED BEVERAGES

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Norman E. Harris  
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Food Laboratory  
U. S. ARMY NATICK LABORATORIES  
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## ABSTRACT

This study was initiated by a request to feed "volunteer" military services foods that are not only nutritious but acceptable. Specifically, beverages were singled out since they constitute products of processed fruit juices and fruit-flavored beverages of which there are over 100 different types at the marketplace. In order to clarify and attempt to reduce costs of military procurement this report lists beverages classified according to their product types, their range in cost per 6 fluid oz. serving, and other data that describe the product such as its nutritional characteristics and the like.

Since the services buy beverages based on a degree of conscious definition and planning of the entire dietary (in terms of nutritional content, acceptability, shelf life, utility and costs) this study was directed to serve as background information written in non technical or semi-technical terms for use by planners or anyone else involved in procurement.

The study accordingly proceeded largely on the basis of a survey of over 100 different products offered by three representative supermarkets in the Greater Boston area. Data on product characteristics, available federal standards, nutritional aspects, flavor, cost and additives were obtained for these items, which were classified into five distinct groups: fresh juices, frozen concentrates, canned and bottled beverages, beverage base powders and liquid beverage base concentrates.

## SURVEY OF NONCARBONATED FRUIT JUICES AND FRUIT FLAVORED BEVERAGES

### I. Introduction

The commercial market place offers a multiplicity of products for consumption as fruit juice beverages. Information on their compositions, nutrient contents and other product characteristics which may serve as value determinants is fragmentary, however, and not systematically available to the military. Therefore this study was undertaken recently by the Food Laboratory in response to increasing military interest to satisfy a volunteer service with products that deliver the highest nutrient value per serving cost without sacrificing acceptance and quality. In order to expedite this task, it became clear that most of this information could be found in supermarkets where most beverages were available on a year-around basis.

This report was written in semi-technical or non-technical language so that a government procuring agency such as the Defense Personnel Support Center could, as an example, understand the function of certain food additives in beverages and that not all products do in fact contain all natural juice. Additionally, this information could be made public to benefit a buyer in the marketplace, although admittedly no buyer under normal circumstances except in industry, would reflect this degree of conscious definition and planning.

Products in the military menu fall into one of two classes: they are either (a) part of a nutritionally planned diet or (b) they are supplements, over and above nutritional needs, issued primarily for taste and morale value. Standards for military selection of products are based on reasonably well-defined requirements for acceptability, shelf life, and nutritional content. Their use is based on cost constraints, which have been established for the entire dietary of which any given food item may be a component.

### II. Approach

The approach used was to review (a) such other federal documents as were then available to NLABS and (b) a survey of products offered in the market place. Because of limited time and resources, the product survey was limited to three supermarkets in the Greater Boston area. One supermarket was selected because it is national in sales while the other two are progressive chains confined to the New England or Middle Atlantic States. It should be recognized that pricing structure could vary in other parts of the country, is subject to change and that the prices cited are valid as comparison indicators only in those stores surveyed in the Greater Boston area. In addition, some of the products surveyed are governed by various state standards in certain parts of the country (see Appendix III).

The following data were collected for each product surveyed to determine potential relevance to consumer choice:

- a. Product
- b. Supplier
- c. Brand name
- d. Flavor
- e. Product type, e.g., ready-to-drink, reconstitution ratio, etc.
- f. Package type
- g. Yield/unit or weight
- h. Cost/unit
- i. Cost/serving (6 fluid oz.)
- j. Label declaration

Three types of products dietetic and carbonated beverages and electrolyte mixtures, were deliberately excluded from the survey. Reasons for their selection by consumers are believed to be distinct from those considered in this study. The first two represent broad classes of drinks entirely different from juices. Although thirst-quenching, dietetic drinks contain little from a nutritional standpoint, other than fluid and a few calories. Carbonated drinks (soda) are similarly formulated flavors providing mostly sugar for energy and in some cases a stimulant (caffeine). The sweetener used in dietetic drinks is mainly saccharin since the FDA cyclamate ban. The optional sweeteners used in the soft drinks are sugar, dextrose, corn syrup, invert sugar, used singly, or in combinations. The soft drink field has taken on a new dimension with the introduction of oral electrolyte mixtures intended to replace fluid and electrolytes lost through excessive perspiration as well as to quench thirst. According to *The Medical Letter on Drugs and Therapeutics* Vol. II, No. 17, August 22, 1969, however, oral electrolyte solutions contain only 21 millequivalents of sodium per liter, which may compensate for the loss of sodium in sweat if the loss is low, but the ordinary diet will provide all the sodium needed in such cases. Whatever the loss, unless the user enjoys drinking large amounts of electrolyte solutions, he will do as well with salt tablets. These generally provide 1.5 gram of salt per tablet, and the daily intake can be easily regulated.

### III. Findings

#### A. Federal Standards and Laws

##### 1. Labeling Laws and Standards of Identity

Federal standards of identity have been promulgated for fresh and canned orange juice and orange juice products as well as for frozen concentrate for lemonade, canned pineapple juice and canned prune juice. Although proposed in 1964, federal standards of identity have yet to be adopted for diluted fruit juice bases and diluted fruit juice beverages. Examples of definitions which the proposed standards would provide are summarized below.

a. To be labeled "— — — — Juice Drink," the product must at least have a juice content of at least 50%. Example: "Orange Juice Drink" would contain at least 50 percent orange juice on a single-strength basis.

b. For beverages labeled "— — — — Ade," the juice content cannot be less than 25 percent of the volume of the finished product, except that cranberryade, lemonade or lemon-limeade may go as low as 12.3 percent.

c. For beverages labeled "— — — — Drink," the juice content could not be less than 10 percent of the volume of the finished product, except that cranberry, lemon, lime or lemon-lime drinks may have as little as 6 percent. Example: "Grape Drink" would require 10 percent juice on single-strength basis.

d. Beverages labeled "— — — — Flavored Drink" would have juice contents less than 10 percent; cranberry, lemon, lime and lemon-lime may have less than 6%. Example: "Cherry Flavored Drink" would be a drink with a juice content less than 10%.

e. Fruit nectars is a term used to designate pulpy fruit juices blended with sugar syrup which may contain water, artificial color, flavoring, and acid to produce a ready-to-drink beverage. Because fruit nectars contain added water, they cannot be called fruit juices. Examples include apricot, peach, pear and plum nectars.

## 2. United States Standards for Grades

Not all juices are graded. Grading is a voluntary service made available to processors administered under the jurisdiction of the U.S. Department of Agriculture. Fees and Charges for inspection are paid for by the processors. Not all juices are produced in four grade levels. The following grades may be used:

- |                                |                                  |
|--------------------------------|----------------------------------|
| a. U.S. Grade A or U.S. Fancy  | c. U.S. Grade C or U.S. Standard |
| b. U.S. Grade B or U.S. Choice | d. Substandard                   |

Below is a score sheet for grading frozen concentrated orange juice, a perfect score is 100 points:

Score Chart for Frozen Concentrated Orange Juice

Factors	Points Maximum	Grade A Fancy	Grade B Choice	Substandard
Color	40	36-40	32-35 <sup>1</sup>	0-31 <sup>1</sup>
Defects	20	18-20	16-17 <sup>1</sup>	0-15 <sup>1</sup>
Flavor	40	36-40	32-35 <sup>1</sup>	0-31 <sup>1</sup>

# Score Chart for Frozen Concentrated Orange Juice (cont'd)

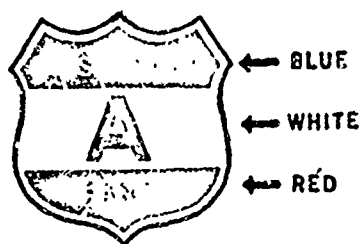
Factors	Points Maximum	Grade A Fancy	Grade B Choice	Substandard
Minimum Score	-	90	80	

Source: U.S. Dept. of Agriculture Standards for Grades of Frozen Concentrated Orange Juice, 21 September 1968.

1 Indicate limiting rule: Frozen concentrated orange juice falling in this classification cannot earn higher grade, regardless of total score. Products are marked with a USDA shield, e.g., Grade A.

Examples of USDA inspection and grade marks are illustrated below:

a. Grade marks. The approved grade mark or identification may be used on containers, labels or otherwise indicated for any processed product that (1) has been packed under continuous inspection as provided in this part to assure compliance with the requirements for wholesomeness established for the raw product and of sanitation established for the preparation and processing operations, and (2) has been certified by an inspector as meeting the requirements of such grade, quality or classification. The grade marks approved for use shall be similar in form and design to the examples in Figures 1 through 5 of this section.



Shield using red, white, and blue background or other colors appropriate for label.

Figure 1.



Shield with plain background.

Figure 2.

U. S. GRADE A  
Figure 3.

U. S. CHOICE  
Figure 4.

U. S.  
GRADE  
B

Figure 5.

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best available copy.

b. Inspection marks. The approved inspection marks may be used on containers, labels or otherwise indicated for any processed product that (1) has been packed under continuous inspection as provided in this part to assure compliance with the requirements for wholesomeness established for the raw product and of sanitation established for the preparation and processing operations, and (2) has been certified by an inspector as meeting the requirements of such quality or grade classification as may be approved by the Administrator. The inspection marks approved for use shall be similar in form and design to the examples in Figures 6, 7, and 8 of this section.



Statement enclosed  
with a shield.

Figure 6.

PACKED UNDER  
CONTINUOUS  
INSPECTION  
OF THE  
U. S. DEPT. OF  
AGRICULTURE

Figure 7.

PACKED BY  
.....  
.....  
UNDER CONTINUOUS  
INSPECTION OF THE  
U. S. DEPT. OF AGRICULTURE

Figure 8.

c. Combined grade and inspection marks. The grade marks set forth in paragraph (a) of this section and the inspection marks set forth in paragraph (b) of this section may be combined into a consolidated grade and inspection mark for use on processed products that have been packed under continuous inspection as provided in this part.

d. Products not eligible for approved identification. Processed products which have not been packed under continuous inspection as provided for in this part shall not be identified by approved grade or inspection marks (except honey and maple sirup which may bear such grade marks), but such products may be inspected on a lot inspection basis as provided in this part and identified by an authorized representative of the Department by stamping the shipping cases and inspection certificate(s) covering such lot(s) with an officially drawn sample mark similar in form and design to the example in Figure 9 of this section.



Figure 9.

e. Licensing and identification of certain official devices. The Administrator may issue licenses permitting the manufacture, identification, distribution, and sale of any official device designated as a USDA color standard, defect guide or other similar aid under such terms and conditions as may be specified by the Administrator. Licenses shall be available to all persons meeting conditions prescribed by the Administrator, shall be nonexclusive, and shall be revocable for cause. No person shall manufacture, identify, distribute or sell any such official device except at the direction of, or under license from, the Administrator. Such official devices may be marked, tagged or otherwise designed with the prefix "USDA" together with other identifying words or symbols, as prescribed by the license.

#### B. Product Descriptions and Data

Data were obtained on more than 100 different commercial products. Analysis of the data suggested that their functional properties as well as cost ranges fall into five different groups: fresh juices, frozen concentrates, canned and bottled beverages, beverage base powders and beverage base liquid concentrates. For each of these groups, findings are summarized in terms of categories which may aid consumers in making choices, that is:

- a. Product characteristics
- b. Applicable specifications and standards (established and proposed)
- c. Flavors and costs
- d. Nutritional characteristics
- e. Use of additives and preservatives.

Cost comparisons of the different types surveyed are furnished in Appendix II and guidelines for interpreting nutritional data are provided in Appendix IV.

##### 1. Fresh Juices

###### a. Product Characteristics

Fresh fruit juices have the advantage of being convenient, or being ready-to-drink, but are highly perishable and must be refrigerated and used promptly to maintain their highest quality. Under federal labelling law, fresh juices must contain 100% juice unless formulated with optional sweeteners or acidifying agents. Products such as orange juice, Concord grape juice, grapefruit juice, etc. are usually more acceptable when sugars are added, especially if any harsh, tart, or bitter notes in the original product are present.



As all fresh juice is highly perishable, it is normally pasteurized to reduce spoilage from microorganisms. The consumer should remember to keep fresh juices refrigerated at all times, and to use them as soon as possible. Although shelf life may vary depending, on many factors such as the original condition of the juice, kind, processing techniques, etc., it generally approximates 2-3 weeks for juices stored at 32°F, in paper cartons. It should be remembered, however, that the juices could be almost a week old when they are purchased. As the product is undated, the purchaser has no way of determining its past history or age. Also, grocery storage cabinets are not normally maintained as low as 32°F. Thus, assuming a 40°F. storage temperature, shelf life could be reduced. To extend the shelf life, preservatives such as sodium benzoate or sorbic acid may be added as optional ingredients in fresh orange juice. None of the fresh juice products seen in the three stores surveyed contained any preservatives.

b. Available Standards:

USDA Standard for Grades of Fruit Juices and Products

Juice	Effective date
Grape Juice	May 14, 1951
Grapefruit Juice	December 7, 1968
Lemon Juice	December 8, 1962
Orange Juice	July 1, 1969
Pineapple Juice	March 16, 1957
Tangerine Juice	July 1, 1969
Orange Juice, Pasteurized	July 1, 1969

FDA (Food and Drug) Standards of Identity

Orange Juice and Orange Juice Products	July 1, 1964
--	--------------

c. Flavors and Costs:

Costs varied more among brands within each store than among stores. Buying juice in larger bottles, depending on service needs and usage, could result in savings of 2 cents for apple juice and 3 cents for orange juice per serving.

Fresh orange juice is sold in 32 and 64 fluid oz. glass bottles and in quart-sized paper cartons. Grapefruit juice is sold in 32 fluid oz. glass bottles, and apple cider in 1/2-gallon and 1-gallon glass jugs. If a person bought cider by the gallon in lieu of by 1/2-gallon size, he could realize a savings of nearly 2 cents per serving.

TABLE I. Fresh Juices — Comparative Costs

Flavor	Costs (cents) (Per 6 fluid oz.)
Orange	6.6 — 9.2
Grapefruit	8.4
Apple Cider	4.2 — 6.5

d. Nutritional Aspects (see Table 2)

Orange juice is richer nutritionally than grapefruit or apple juice. It exceeds grapefruit juice in 15 of 17 nutrients and apple juice in 11 of 17. It is a rich source of vitamins A and C. One glass (6 fluid oz.) provides enough vitamin C to meet recommended daily requirement of 60 mg. All fruit juices are metabolized by the body to provide alkaline ash even though they are acid in taste. Apple juice is fairly high in iron compared with orange juice, but is a poor source of ascorbic acid and contains little or no vitamin A. Compared to prune juice, however, it contains only one-seventh the amount of iron.

TABLE 2.- Fruit Juices, Fresh — Nutritional Data<sup>1</sup>

	Water %	Calories	Protein g	Fat g	Carbohydrates			Ash g	Calcium mg	Phosphorous mg	Iron mg	Sodium mg	Potassium mg	Vitamin A I. U.	Vitamin B <sub>1</sub> mg	Vitamin B <sub>2</sub> mg	Niacin mg	Vitamin C Ascorbic Acid mg
					Total g	Fiber g												
Orange Juice (see varieties)	88.3	45	0.7	0.2	10.4	0.1	0.4	11	17	0.2	0.2	1	200	200	0.09	.03	0.4	50
Grapefruit (see varieties)	90	39	0.5	0.1	9.2	trace	0.2	9	15	0.2	0.2	1	162	80	0.04	.02	0.2	38
Apple Cider	87.8	47	0.1	trace	11.9	0.1	0.2	6	9	0.6	0.6	1	101	---	.01	.02	0.1	1

<sup>1</sup> Source: Agriculture Handbook No. 8 per 100 grams (3.35 oz. average)

#### e. Additives and Preservatives

As noted above, sweeteners may be added to fresh juices, e.g., orange and grapefruit juice, to overcome harsh flavor notes such as sourness and bitterness. Sweeteners consist of the following sugars: sucrose, dextrose, dried corn syrup, dried glucose syrup, or invert sugar. Invert sugar is produced from sucrose by acid inversion and contains two sugars, glucose and fructose. Invert sugar is 1.3 times sweeter than regular sugar. Sorbic acid and sodium benzoate were not added to any of the fresh juices seen in the stores.

One company offered an orange beverage which was sold in the refrigerated dairy case of one store. The product contained added water as the major ingredient and chemical additives such as invert sugar, citric acid, sodium citrate, vegetable oil, polyglyceryl esters, ascorbic acid, gums acacia, algin, orange oil and beta-carotene. It was labelled with a name which customarily implies the highest quality. Citric acid is used to make the juice taste tart and effect a better balance between sweetness and tartness. The proportion of sugar to acid is usually expressed as the Brix/acid ratio. Sodium citrate functions as a buffer to maintain proper pH. Vegetable oil can be used as a carrier for flavors while polyglyceryl esters are emulsifiers or stabilizing agents used to minimize separation of the oil and water phases. Ascorbic acid, another additive, is vitamin C. This vitamin is water-soluble and very easily oxidized or destroyed. Gum acacia and algin are thickeners or stabilizers which increase viscosity of the product to produce a less watery mouth feel. Orange oil is used to produce a more typical orange flavor and aroma. Beta-carotene is used for coloring the juice drink to a more natural color and is a source of provitamin A.

## 2. Frozen Concentrates

#### a. Product Characteristics

Frozen concentrated juices are produced by removing water from the juices of mature fruit. Fresh juice may be added back for aroma and flavor enhancement during the processing. The concentrate so obtained is frozen. As an example, to produce orange juice concentrate, orange oil, orange pulp, orange essence (obtained from orange juice), orange juice, and other orange juice concentrate, and sweeteners may be added. Finished orange juice concentrate is of such concentration that 1 part is diluted with 3 parts of water to make single strength. It then will contain not less than 11.8% by weight of orange juice soluble solids, exclusive of the solids of any added optional sweetening ingredients.

Frozen concentrated juices are highly perishable and should be kept frozen to maintain their high commercial quality. The advantage of frozen juices is that they are low in cost, high in quality and can be stored for approximately two years at 0°F. or below.

On the debit side, they must be kept frozen until use, requiring freezer space. Also, they are not as convenient as fresh juice, as they must be thawed to remove the product, then diluted with water to reconstitute. Frozen juices are usually 3 + 1, while most fruit punches are 4-1/3 + 1. Three plus one means that 1 part of concentrate is diluted with 3 parts of water. It is then ready-to-drink. If a juice has been thawed, its quality may be affected, as chemical and other changes occur more rapidly at higher temperatures. Refreezing at higher temperatures forms larger ice crystals that could change texture. Freeze-thaw-freeze cycling is not thought to be harmful if the product is not contaminated and is refrozen immediately. Use of a thaw indicator has been suggested by some consumer groups. Producers have resisted the use of indicators, however, as such devices are located on the exterior of shipping containers may not reflect actual product temperature. Moreover, thawing of the product does not necessarily mean it is spoiled. In most cases it is not.

Even though the producer has little or no direct control over the product after it leaves his hands, he is now considered responsible. Therefore he should periodically check distribution channels and use codes to make sure that his products are being handled properly and sold on a FIFO, or first in, first out system.

#### b. Available Standards

##### USDA Standards for Grades of Frozen, Concentrated, Juices

Juice	Effective Date
Grape Juice, Conc. Sweetened	Nov. 1, 1957
Grapefruit Juice, Conc.	Oct. 1, 1970
Grapefruit Juice & Orange Juice, Conc. Blended	Sept. 21, 1968
Lemonade, Conc. for	Sept. 21, 1968
Limeade, Conc. for	Sept. 21, 1968
Orange Juice from conc.	July 1, 1969
Orange Juice, Conc.	Sept. 21, 1968

##### FDA (Food and Drug) Standards of Identity

Orange Juice & Products	July 1, 1964
Frozen concentrate for lemonade	Dec. 14, 1966

Federal or Military Specifications (Applicable to Government Purchase Only)

Juice	Specifications	Latest Revision
Juice, Orange, Frozen, Conc.	Z-J-1398	Jan. 24, 1969
Juice, Grapefruit, Frozen, Conc.	Z-J-825	Jan. 24, 1969
Juice, Grape, Frozen, Conc.	Z-J-815	Nov. 2, 1959
Juice, Grapefruit & Orange, Frozen, Conc.	Z J-874	June 6, 1963
Juice, Lemon, Frozen, Conc.	MIL-J-11174	Dec. 19, 1969

c. Flavors and Costs

Frozen concentrated juices are available in fewer flavors than canned or bottled beverages, but are almost as reasonable in price as drinks which contain little natural juice. Thus they are considered the best buy when judging overall quality, especially for orange juice. Cranberry juice cocktail, apricot nectar and prune juices are never sold frozen in the retail store. They contain added water and sugar and are not pure juices.

Costs varied according to brand for frozen juices within each store. The private labels, or store brands, and larger sizes were less expensive. Grapefruit juice made from frozen concentrate was more expensive than either orange or grape juices. Orange juice reconstituted from the frozen concentrate was an excellent buy, being sold in paper cartons in the dairy section in the ready-to-drink form along with other refrigerated fresh juices. This product, however, was available in only one of the three stores surveyed. To improve keeping qualities, it is heat-treated (pasteurized), which may result in a more pronounced heat-processed flavor than is characteristic of either fresh or frozen concentrated juice.

The price range for a 6 fluid oz. serving of juice varied from a low of 3.6 cents for ready-to-drink reconstituted orange juice from frozen concentrate to a high of 6.9 cents for frozen concentrated blend of orange and pineapple or grapefruit juice.

TABLE 3.- Frozen Concentrates — Comparative Costs

Flavor	Cost (cents) (per 6 fluid oz.)
Orange Juice	4.1 — 6.3
Orange Juice reconstituted, ready-to-drink (from concentrate)	3.6
Grapefruit juice	6.6
Grape juice <sup>1</sup>	5.1 — 5.8
Combinations juices (orange & pineapple/or grapefruit)	5.2 — 6.9
Natural & Imitation beverages	5.6 — 6.1
Imitation beverages <sup>2</sup>	4.6 — 5.1

<sup>1</sup> Sugar, citric acid, and vitamin C added.

<sup>2</sup> See Sub par. f. below

d. Nutritional Aspects.

From a nutritional standpoint, the natural vitamin content of the frozen concentrate should be equal to or better than that of fresh or canned juices. During processing and storage there is a gradual loss of vitamin C in canned juices depending on many factors such as amount of trace metals such as copper, exposure to heat, air, etc. Most manufacturers fortify canned or bottled juice with extra vitamin C, so that frozen concentrates may not in fact always be superior nutritionally to other forms of juices.

e. Additives and Preservatives

Frozen juices do not contain as many additives as do canned juices. Grape juice, however, normally contains added vitamin C, sweeteners and citric acid. Vitamin C is added in the quantity to most grape juices so that an 3-fluid-oz. serving supplies 30 mg. vitamin C or 1/2 the recommended daily requirement. Citric acid is added to juices to provide sourness or the proper sweet/acid taste, sometimes referred to in the trade as the Brix-acid ratio.

Fruit punches contain, in addition to the additives discussed above, dextrin, gum acacia, natural fruit flavors and artificial color. Dextrin and gum acacia help to control viscosity and enhance mouth feel, making the juice seem less watery. Natural fruit flavors are mainly essential oils or essences which boost the overall natural flavor and aroma. Artificial color is used to make the juice seem more natural in shade, or more attractive.

f. Frozen Concentrated Orange Beverages, Natural and Imitation, and Imitation Frozen Concentrated Orange Beverages.

One company offers a line of two orange-flavored grocery products that compete with the natural frozen orange concentrates. They are kept frozen and must be thawed and diluted with water to make a total of 48 fluid oz. of ready-to-drink beverage which must be kept refrigerated. Costs varied as much as 0.5 cent per serving among the three stores surveyed. The price ranged from 4.6 - 5.1 cents for the imitation orange flavored to 5.6 - 6.1 cents per serving for the natural and imitation product. The beverages were not essentially different in price from natural orange juice, and in some cases, were higher. The composition of these products is outlined below. It should be noted that concentrated orange juice predominates in the natural imitation product but is not a component of imitation products.

Sweetener:	Sugar sirup, Corn sirup
Dilutent:	Water
Flavor:	Orange pulp, Natural and Artificial flavor, Concentrated Orange juice, Orange rind

Thickener-carrier: Gum arabic, Vegetable oil, Cellulose gum  
Buffer: Potassium citrate, Calcium phosphate, Potassium phosphate  
Vitamins: A, B, C  
Color: Artificial  
Acidulant: Citric Acid

### 3. Canned and Bottled Beverages

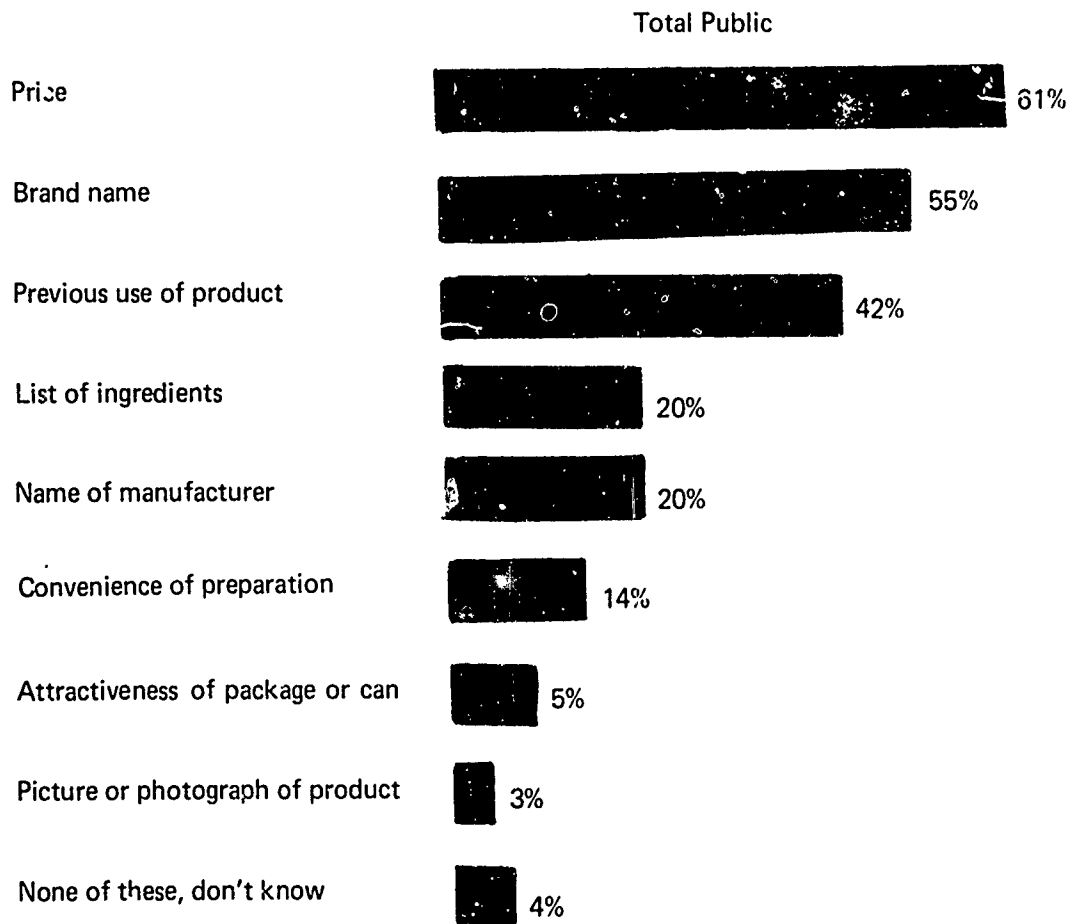
#### a. Product Characteristics

Canned or bottled fruit juices are sold in many varieties and forms. They constitute at least one-half an aisle or side in many supermarkets. There are about 100 different kinds of beverages made up of juices, fruit-juice drinks, drinks, nectars, etc. One store visited had nine different brands of orange. In a situation of this kind, the consumer could be thoroughly confused as to what constitutes the best buy. Most shoppers choose brand name items, or judge a product by its price (see Table 4). As beverages may differ in composition and are sold in different sizes, containers, etc. which can affect the price considerably, this is not necessarily a good principle of choice. Juices in bottles may cost more than those in cans as bottles and caps are more expensive than cans of comparable size. On the other hand, shelf life of some juices, cranberry and lemon for example is greater in bottles than in cans. Other factors which complicate buying include the difficulty of determining price on a unit basis as well as the consumer's normal unawareness of how much actual fruit juice is contained in the product. Admittedly, prudent shopping is not an easy task, so most people tend to select by brand name or buy the private label offered by the store. If one bought apple juice bearing the label of the store, for example, he could save about 1 cent per 6 fluid oz. serving. This assumes that the juices are comparable in quality. If comparable products bear the USDA shield of Grade A Fancy, the consumer should pick the one with the lowest price. This assures him of a good buy. Some packs are not graded. Also, some products differ as to source. A few shoppers either do not care what price they pay, or are so busy that they pick up their groceries as rapidly as possible. In this case they apparently choose items mostly by preference or possibly convenience of location. That is why supermarkets promote certain items by placing them near the check-out counter or in a very conspicuous spot that is difficult for the shopper to miss or pass by. Also, supermarkets many times advertise beverages as a loss leader to draw people into their stores.



**TABLE 4.- Considerations When Comparing Food Products**

"When comparing two or more packages or cans of the same type food, which of the things on this card do you consider before deciding which product to select?"



Source: Survey by Opinion Research Corp. for Hoffmann - LaRoche Inc. "Public Attitudes Toward Added Vitamins in Foods."

As to processing, fruit juices are high-acid products which lend themselves well to low-heat treatment, or pasteurization. Heat-processing produces flavor changes which, in most cases, are not desirable. Low heat or "flash" methods are thus preferable to assure good quality. To maintain quality, beverages are therefore always heat-processed in hermetically-sealed (airtight) glass or tin containers. This results in products which can be stored at room temperature for 6-9 months without appreciable quality losses. The consumer should remember to keep canned beverages chilled after opening. This does not appear to present any special problem since most juices or beverages are served chilled.

Cans and bottles from these beverages could be potential sources of pollution of the environment, but probably not to the extent that beer or soda cans and bottles are, since most juice drinks are normally consumed at post. Notwithstanding, many people consume soda and beer away from home either because they prefer these drinks to juices or because juices are not available. This situation presents a continuing problem but is not part of this study.

#### b. Available Standards

##### USDA Standards for Grades of Canned Juices

Juice	Effective Date
Canned Apple Juice	June 26, 1950
Grape Juice	May 14, 1951
Grapefruit Juice	Dec. 7, 1968
Grapefruit and Orange Juice, Blended	July 1, 1969
Lemon Juice	Dec. 8, 1962
Orange Juice	July 1, 1969
Pineapple Juice	Mar. 16, 1957
Tangerine Juice	July 1, 1969

##### FDA (Food and Drug) Standards of Identity Quality and Fill

Cranberry Juice Cocktail	Stayed
Fruit Juice Drinks	Stayed
Orange Juice and Orange Juice Products	July 1, 1964
Pineapple Juice	Feb. 6, 1966
Prune Juice	Aug. 17, 1956

Federal or Military Specifications for Canned Fruit Juices  
(Applicable to Government Purchases only)

Juice	Specification	Latest Revision
Orange Juice Concentrated, Canned	Z-O-670	Nov. 29, 1961
Juice, Orange, Canned	Z-J-875	Mar. 7, 1963
Pineapple Juice, Canned	Z-P-356	Nov. 29, 1961
Juice, Grapefruit, Canned	Z-J-00820	May 12, 1970
Grapefruit & Orange Juice, Canned	Z-G-691	Jan. 7, 1955
Grape Juice, Single-Strength, Canned	Z-G-661	Nov. 29, 1961
Apple Juice, Single-Strength, Canned	Z-A-623	Nov. 30, 1961

c. Flavors and Costs

Eight flavors (Table 5) of either bottled or canned juices were surveyed. To conform to the FDA standards listed above, they cannot be diluted with water and sold as juices. Their prices ranged from a low of 3.4 cents for orange blends to a high of 19.6 cents per 6 fluid oz. serving for prune juice which was provided in a 4-pack of individual servings, each containing 4 fluid oz. The cost per serving was lowest for the following juices: orange-pineapple blend at 3.4 cents, orange 4.2 cents, pineapple 4.2 cents and apple 4.6 cents. Canned apple juice was 0.5 cent lower per serving than bottled apple juice. The canned juice prices varied from store to store, and from brand to brand.

The drinks are shown in Table 6. These are products which would contain only 10% juice by volume according to the proposed standards cited above. It is surprising to note that the drinks cost nearly as much as juices, despite the fact that in most cases they contain very little natural juice by volume. Canned orange, apple, and pineapple were low-priced drinks, while "punches" were the highest in price.

TABLE 5.- Canned or Bottled Juices — Comparative Costs

Flavor	Cost (cents) (per 6 fluid oz.)
Orange, canned	4.2 — 9.8
Grapefruit, canned	5.9 — 11.5
Pineapple, canned	4.2 — 10.2
Prune, canned <sup>1</sup>	9.2 — 11.0
Prune, bottled <sup>1</sup>	7.2 — 19.6
Apricot, canned	6.2 — 12.5
Apricot, nectar, bottled	6.9

TABLE 5.- Canned or Bottled Juices -- Comparative Costs (Continued)

Flavor	Cost (cents) (per 6 fluid oz.)
Orange & Pineapple/or Grapefruit, canned	3.4 - 11.5
Orange & Pineapple/or Grapefruit, bottled	5.0 - 7.3
Cranberry Juice, Cocktail, bottled <sup>2</sup>	6.2 - 14.8
Apple, canned	4.6 - 10.0
Apple, bottled	5.1 - 10.0
Grape, bottled	8.1 - 11.25

<sup>1</sup> Not less than 18.5% water soluble solids extracted from dried prunes.

<sup>2</sup> Amount of juice is greater than 25% by volume of equivalent single-strength cranberry juice.

TABLE 6.- Canned or Bottled Drinks - Comparative Costs

Flavor	Cost (cents) (per 6 fluid oz.)
Orange	3.4 - 5.2
Pineapple	4.6
Grape	8.1 - 11.25
Apple	4.3
Apple Nectar	8.8
Punch	3.4 - 11.5
Cranberry - Apple	5.5 - 8.1
Nectar	3.4 - 9.9

#### d. Nutritional Aspects

Orange juices lose about 10% vitamin C on processing when compared with fresh juices, while canned grapefruit juices lose about 4%. Juices that are more acid, e.g., Concord grape could run as high as 50% added sugar on a solids basis (Brix). Juices contain such small amounts of vitamins B<sub>1</sub>, B<sub>2</sub>, niacin, etc., that even a 50% loss during processing would have little overall nutritional impact. There appears to be little, if any, loss of vitamin A or minerals during processing. The mineral content (ash) are not affected by heat. Of the canned beverages, prune is the richest source of iron and could be used advantageously by consumers who have been advised to supplement their diets with iron.

Juices are not rich sources of protein and fat, but do contain considerable quantities of carbohydrates (sugars) and in general produce energy equivalent to 43.77 calories for a 3.5 oz. serving.

TABLE 7.- Canned or Bottled Juices<sup>1</sup> — Nutritional Data

	Water %	Calories	Protein g	Fat g	Carbohydrates Total			Calcium mg	Phosphorous mg	Iron mg	Sodium mg	Potassium mg	Vitamin A (Prov. Carotene) I. U.	Vitamin B <sub>1</sub> Thiamine mg	Vitamin B <sub>2</sub> Riboflavin mg	Niacin mg	Vitamin C Ascorbic Acid mg
					g	g	g										
Orange, Canned Unsweetened	87.4	48	0.8	0.2	11.2	0.1	0.4	10	18	0.4	1	199	200	0.7	.02	0.3	40
Orange, Canned Sweetened	86.5	52	0.7	0.2	12.2	0.1	0.4	(10)	18	0.4	1	(199) <sup>2</sup>	200	.07	.02	0.3	40
Grapefruit Juice Unsweetened	88.7	43	0.6	0.2	10.1	0.1	0.4	10	15	0.3	1	184	100	.05	.02	0.2	34
Grapefruit Juice Sweetened	86.9	50	0.5	0.1	12.2	0.1	0.4	10	15	0.3	1	184	100	.05	.02	0.2	34
Grape	82.9	66	0.2	trace	16.6	trace	0.3	11	12	0.3	2	116	----	.04	.02	0.2	trace
Cranberry Cock- tail about 33% Juice	83.2	65	0.1	0.1	16.5	trace	0.1	5	3	0.3	1	10	trace	.01	.01	trace	40 <sup>3</sup>
Apple, Canned or Bottled	47		0.1	trace	11.9	0.1	0.2	6	9	0.6	1	101	----	.01	.02	0.1	1
Apricot	84.5	54	1.0	0.2	13.6	0.4	0.7	17	23	0.5	1	362	2700	.03	.03	0.5	6
Prune	80	77	0.4	0.1	19.0	trace	0.5	14	20	4.1	2	235	----	.01	.01	0.4	2

<sup>1</sup> Source: Agriculture Handbook No. 8 per 100 grams (3.35 oz. average). If label claim is 30mg/8 fluid oz. serving, values would be 12mg/100g<sup>2</sup> Values estimated<sup>3</sup> Added to approximately this composition

TABLE 8.- Canned or Bottled Fruit Juice, or Fruit Juice Drinks — Nutritional Data<sup>1</sup>

Water	Calories	Protein	Carbohydrates				Calcium	Phosphorous	Iron	Sodium	Potassium	Vitamin A		Vitamin B <sub>1</sub>	Vitamin B <sub>2</sub>	Thiamine	Riboflavin	Niacin	Vitamin C
			Fat	Total	Fiber	Ash						I. U.	mg						
%		g	g	g	g	g	mg	mg	mg	mg	mg		mg		mg		mg	mg	mg
Orange juice and Apricot juice drink	86.7	50	0.3	0.1	12.7	0.2	0.2	5	8	0.1	trace	94	580	.02	.01	.02	.01	0.2	16
Lemonade conc. diluted H <sub>2</sub> O	88.5	44	0.1	trace	11.4	trace	trace	1	1	trace	trace	16	trace	trace	.01	trace	.01	0.1	7
Grapefruit and orange juices blended unsweetened	88.7	43	0.6	0.2	10.1	0.1	0.4	10	15	0.3	1	184	100	.05	.02	.05	.02	0.2	34
Pineapple juice and grapefruit juice about 40% fruit juice	86	54	0.2	trace	13.6	trace	0.2	5	5	0.2	trace	62	10	.02	.01	.02	.01	0.1	16
Pineapple juice and orange juice drink about 40% fruit juice	86	54	0.2	0.1	13.5	trace	0.2	5	6	0.2	trace	70	50	.02	.01	.02	.01	0.1	16
Apricot nectar about 40% fruit	84.6	57	0.3	0.1	14.6	0.2	0.4	9	12	0.2	trace	151	950	.01	.01	.01	.01	0.2	3
Grape juice drink, about 30% grape juice	86	54	0.1	trace	13.8	trace	0.1	3	4	0.1	1	35	---	.01	.01	.01	.01	0.1	16 <sup>2</sup>
Pear Nectar	86.2	52	0.3	0.2	13.2	0.3	0.1	3	5	0.1	1	39	trace	trace	.02	trace	.02	trace	trace

<sup>1</sup> Source: Agriculture Handbook No. 8 per 100 grams (3.53 oz. average). If label claim is 30mg/8 fluid oz. serving, values would be 12mg/100 g.<sup>2</sup> Added to approximately this composition

e. Additives and Preservatives

Most of the canned natural fruit juices do not contain any additives other than sweeteners as defined earlier in this report. The beverage drinks, however, may contain as many as 7-8 different chemical additives.

In the beverages surveyed there were a total of 31 different chemical additives which will be grouped as to function to simplify definition.

(1) Preservatives or Antioxidants

Sulfur dioxide  
Sodium benzoate  
Stannous chloride

(2) Acidulants

Citric acid  
Malic acid  
Fumaric acid  
Tartaric acid

(3) Thickeners-stabilizers or buffers

Algin	Guar gum
Dextrin	Carrageenan
Veg gum	Sodium citrate
Cornstarch	Gum Tragacanth
Gum acacia	Gum arabic

(4) Flavors or Boosters

Natural flavors  
Orange Oil  
~~Grape~~ essence

(5) Colors

Artificial color  
Caramel color

(6) Vitamins

Ascorbic acid — Vitamin C  
Vitamin B<sub>1</sub>, thiamine  
Vitamin B<sub>2</sub>, riboflavin  
beta-carotene (provitamin A) - can  
(Function additionally as a  
yellow color)

(7) Diluent

Water

(8) Cloud agent

Brominated vegetable oil <sup>1</sup>

(9) Anti-foaming agent

Dimethylpolysiloxane

<sup>1</sup> This Chemical can be used on an interim basis as a stabilizer for flavoring oils used in fruit-flavored beverages, provided that no applicable standards of identity preclude its use, in an amount not to exceed 15 parts per million in the finished product, pending outcome of additional toxicological studies on which periodic reports at 6-month intervals are to be furnished and final results submitted to the Food and Drug Administration not later than Dec. 1, 1973. (35 F.R. 19015 Dec. 16, 1970, para § 121.1234).

#### 4. Beverage Base Powders

##### a. Product Characteristics

There are three classes of nutritive dehydrated beverage powders;

1. "high quality" fortified powders formulated with sugar, natural and/or synthetic flavors,
2. beverage powders formulated with sugar and synthetic flavors, and
3. beverage bases formulated with natural and/or synthetic flavors, to which the consumer adds most of the sugar.

All of these products may serve military purposes, especially as many users prefer drinking the imitation flavors which are very thirst-quenching, refreshing and have a long packaged shelf life. They are low in weight and bulk. Estimated shelf life of dry beverages is 36 months at 70°F. If the packaged products are damaged and the contents exposed to heat or moisture, however, they will "cake" or harden, shortening their usable life. Fortified products containing natural orange flavors hold up for about one year at ambient temperatures. The natural oils and vitamins are the most perishable ingredients in the formula. One manufacturer has found "high quality" powders to be equal to frozen orange juice in consumer acceptance.

##### b. Applicable Standards

There are no USDA Standards for grades or Federal Food and Drug Standards of Identity for Quality and Fill covering these products. It should be noted, however, that ingredients used for these products must be FDA approved in compliance with the food additives law.

Federal or Military Specifications (applicable to Government purchases only)

Beverage Base, Powdered      MIL-B-35023      Effective: 23 Feb 1967

##### c. Flavors and Costs

The "high quality" presweetened (sugar), fortified dry base beverages are orange-flavored products. They are competitive in price with other orange beverages (see Table A, Appendix II), ranging from a low of 3.7 cents per fluid oz. per serving to a high of 5.7 cents per serving (see Table 9). The premium priced orange product containing iron costs 1 cent per serving more than for its lower-priced counterpart. Between stores there was a 0.9 cent per serving difference in price, indicating that in some cases comparison shopping may be desirable.



The lower-priced presweetened (sugar) synthetic and imitation flavored beverages retail for 1.8 – 1.9 cents per serving. A consumer adding his own sugar could save nearly 1 cent per serving, which is considerable, as there are about 5 servings per quart.

Although the store survey was taken during the winter when few beverage base powders with artificial or natural flavors (not presweetened) were available, the store managers readily volunteered the basic prices. The cost range was 0.9 to 0.99 cents per 6 fluid oz. serving. This includes the cost of sugar, assuming one paid 12 cents per lb. for sugar. The imitation beverage bases were lowest in cost and a good buy for use in tropical climates where quick energy and thirst are a problem.

TABLE 9 Beverage Bases – Comparative Costs

Flavor	Cost (cents) (per 6 fluid oz.)
Natural and Imitation Flavors, Presweetened, Fortified orange flavor	3.7 – 5.7
Imitation Flavor, Presweetened, strawberry, lemonade, cherry	1.8 – 1.9
Imitation Flavors, orange, lemon, lemon-lime, strawberry, grape, cherry, raspberry	0.91 – 0.99 <sup>1</sup>

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<sup>1</sup> Includes the price of sugar at 12 cents per lb.

d. Nutritional Aspects

The “high quality” bases are fortified to provide more vitamins A and C than like amounts of natural orange juice. A new Orange-flavored beverage product not only provides more than the necessary supply of vitamins A and C but one 4 fluid oz. serving provides 100% of the adult recommended daily requirement for iron. For a person who has been advised to take extra iron, this could be an excellent way to obtain it in a more palatable manner. The less expensive bases provide little from a nutrient standpoint except fluid replacement from added water and calories from sugar.

e. Additives and Preservatives

Sweeteners	Acidulants	Thickeners-Stabilizers
Sugar Dextrose Corn syrup solids	Citric acid Fumaric acid	Gum arabic Cellulose gum Sodium carrageenan
Flavors	Buffers	Fortifiers
Natural orange flavor Artificial flavors	Sodium citrate Calcium phosphate Calcium carbonate	Vitamin C Ferrous sulfate Vitamin A
Carrier	Preservative	Color
Hydrogenated vegetable oil	Butylated Hydroxy- anisole (BHA)	U.S. Certified color
Wetting Agent		
Diocetyl sodium sulfosuccinate (DSS)		

All of the above additives are FDA approved and therefore present no hazard to the health of the consumer according to the best scientific evidence.

5. Beverage Base Liquid Concentrates

a. Product Characteristics

Liquid beverage bases are a special class of beverage concentrates. Normally, one part of the concentrate is diluted with 5 or 7 parts of water to produce the finished beverage. In other words, one gallon of concentrate will yield either 6 or 8 gallons of drink.

The product seen in the three supermarkets was a 1 + 7, or one which yields 8 gallons of beverage from one gallon of concentrate. It was formulated with sugar, water, natural fruit juice, an acidulant such as citric acid, thickener, and a preservative, e.g., sodium benzoate. It is thick, like molasses, and is sometimes called "sirup" by the trade. These products are similar to those normally used at a soda fountain, except that water is used to dilute them in lieu of carbonated water. They have a total shelf life of about 6 months before flavor loss is apparent. The advantage to the consumer is that the product mixes readily with water, and the bulk and weight of the concentrated beverage base

is much less than that of single-strength juices, the latter containing up to 89% water. On the other hand these beverages do not possess the flavor and mouthfeel of natural juices and they retain the "bite" of sodium benzoate flavor which some consumers might find distasteful.

#### b. Applicable Standards

There are no government standards regulating these beverages, however, the law requires that all ingredients be FDA-approved.

Federal or Military Specifications (applicable to government purchases only)

Beverage Bases, Liquid, for Carbonated and  
Noncarbonated beverages to be issued

#### c. Flavors and Costs

TABLE 10.- Liquid Beverage Bases — Comparative Cost Data

Cost (cents) (per fluid 6 oz)

Liquid Beverage Base Concentrate (1+7) 1.6 — 1.9

(Available in orange, cherry, black cherry, raspberry, lemon-lime, strawberry, lemon and grape flavors at the same price.)

#### d. Nutritional Aspects

As shown in Table 11 the major contribution the beverage bases make from a nutritional standpoint is calories. They are generally low in vitamins and minerals, reflecting the small amount of natural juice in the finished beverage.

TABLE 11.- Beverage Bases — Nutritional Values

6 oz. servings of:	Calcium mg	Phosphorous mg	Potassium mg	Vit. A. I. U.	Vit. C mg	Calories
Orange	0.9	1.7	2.3	8	3.7	76
Lemon	1.3	0.8	—	—	2.3	75
Lemon-lime	1.4	0.9	—	—	4.1	76
Grape	1.1	1.1	4.1	8	.75	75
Orange-cherry punch	1.0	1.6	1.6	7.2	1.8	75

e. Additives and Perservatives

Sweeteners: Sugar

Diluent: Water

Flavors: Fruit juices of the flavor designated, Fruit juice concentrates, Orange oil, Lemon and lime oils

Acidulant: Citric Acid

Thickener-Stabilizer: Propylene glycol alginate

Colors: Artificial color, Caramel color

Preservative: Sodium benzoate

All of these ingredients are approved by the FDA and are considered safe in the concentration used, according to available scientific evidence.

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## APPENDICES

- I. Fruit Beverage Products in the Military Supply System
- II. Price Comparisons of Fruit Beverages
- III. Requirements by States (as of 1968)
- IV. Suggested Guide for Interpretation of Nutrient Data
- V. Definitions and Standards for Diluted Fruit Juice Bases and Diluted Fruit Juice Beverages, Association of Food and Drug Officials of the U.S.

## APPENDIX I

### Fruit Beverage Products in the Military Supply System<sup>1</sup>

Cranberry Juice Cocktail, 1 gallon jar.

Juice, Apple Canned, single strength, clear, U.S. Grade A, No. 3 cylinder can.

Juice, Apple, Canned single strength, clear or cloudy, U.S. Grade A, 5-1/4 to 6 fluid oz. can.

Juice, Grape, Canned, single strength, sweetened or unsweetened, Concord type, U.S. Grade A, 5-1/4 to 6 fluid oz. can.

Juice, Grape, Canned, single strength, unsweetened, Concord type, U.S. Grade A, No. 3 cylinder can.

Juice, Grape, Frozen, concentrated 3 + 1 sweetened or unsweetened, Concord type, U.S. Grade A, 32 fluid oz. fiberfoil or metal can.

Juice, Grape, Frozen, concentrated 3 + 1 sweetened or unsweetened, Concord type, U.S. Grade A, 32 fluid oz. metal can.

Juice, Grapefruit, Canned, single strength, sweetened, U.S. Grade A, Style I, No. 3 cylinder can.

Juice, Grapefruit, Canned, single strength, sweetened, U.S. Grade A, Style II, No. 3 cylinder can.

Juice, Grapefruit, Frozen, concentrated, 3 + 1 sweetened or unsweetened, U.S. Grade A, 32 fluid oz. can.

Juice, Grapefruit, Frozen, concentrated, 3 + 1 sweetened or unsweetened, U.S. Grade A, 32 fluid oz. metal can.

Juice, Grapefruit, Instant, sweetened, U.S. Grade A, with desiccant 15-1/2 oz. minimum can.

Juice, Grapefruit and Orange, Canned, single strength, sweetened or unsweetened, U.S. Grade A, 5-1/4 to 6 fluid oz. can.

Juice, Grapefruit and Orange, Canned, single strength, unsweetened, U.S. Grade A, No. 3 cylinder can.

Juice, Lemon, Frozen, concentrated, 3 + 1, 6 fluid oz. metal can.

Juice, Lemon, Frozen, concentrated, 3 + 1, 32 fluid oz. fiberfoil or metal can.

Juice, Lemon, Instant, unsweetened, U.S. Grade A, with desiccant, 2-1/2 qt. yield can.

Juice, Lime, Frozen, single strength, 30 fluid oz. fiberfoil or metal can.

Juice, Lime, Frozen, single strength, 30 fluid oz. metal can.

Juice, Orange, Canned, single strength, sweetened or unsweetened, U.S. Grade A, 5-1/4 to 6 fluid oz. can.

Juice, Orange, Canned, single strength, unsweetened, U.S. Grade A, No. 3 cylinder can.

Juice, Orange, Frozen, concentrated, 3 + 1 sweetened or unsweetened, U.S. Grade A, 12 fluid oz. or 32 fluid oz. fiberfoil or metal can.

Juice, Orange, Frozen, concentrated, 3 + 1 sweetened or unsweetened, U.S. Grade A, 32 fluid oz. metal can.

Juice, Orange, Instant, unsweetened, U.S. Grade A, with desiccant 15-1/2 oz. minimum metal can.

Juice, Pineapple, Canned, single strength, unsweetened, U.S. Grade A, 5-1/2 to 6 fluid oz. can or No. 3 cylinder can.

Juice, Pineapple, Canned, Instant, unsweetened, U.S. Grade A, with desiccant 15 oz. can.

Nectar, Apricot, Canned, 5-1/2 to 6 oz. can, high commercial grade.

Beverage Base, Cherry Powder, imitation base, unsweetened without ascorbic acid, 5 gal. yield.

Beverage Base, fruit punch flavor, liquid natural (ready-to-use) natural and imitation flavoring, sugar sweetened without ascorbic acid, 6 gal. yield, high commercial grade.

Beverage Base, imitation grape, powder, imitation base, sugar sweetened or unsweetened, with or without ascorbic acid, 6 fluid oz. yield pkg., high commercial grade.

Beverage Base, grape, powder, imitation base, unsweetened, without ascorbic acid, 5 gal. yield envelope.



Beverage Base, imitation lemon, powder, sugar sweetened or unsweetened, with or without ascorbic acid, 6 fluid oz. yield pkg., high commercial grade.

Beverage Base, lemon, powder, imitation base, unsweetened, without ascorbic acid, 5 gal. yield envelope.

Beverage Base, lemon, powder, natural base, unsweetened, with ascorbic acid, 12 oz. can.

Beverage Base, imitation lemon-lime, powder, imitation base, sugar sweetened or unsweetened, with or without ascorbic acid, 6 fluid oz. pkg., high commercial grade.

Beverage Base, lime, powder, imitation base, unsweetened, without ascorbic acid, 5 gal. yield envelope.

Beverage Base, orange flavor, liquid, natural (ready-to-use), natural and imitation flavoring, sugar sweetened, without ascorbic acid, 6 gal. yield, high commercial grade.

Beverage Base, imitation orange, powder, imitation base, sugar sweetened or unsweetened, with or without ascorbic acid, 6 fluid oz. yield package, high commercial grade.

Beverage Base, orange, powder, imitation base, unsweetened, without ascorbic acid, 5 gal. yield envelope.

Beverage Base, Assortment, powder, imitation base, sugar sweetened, with ascorbic acid, 45 34-gal. envelopes per box (Flavors: cherry, grape, lemon, lime, orange).

Beverage Base, Assortment, powder, imitation base, unsweetened, with ascorbic acid, 80 5-gal. yield envelopes per case (Flavors: cherry, grape, lemon, lime, orange).

Beverage Base, Assortment, powder, imitation base, unsweetened, without ascorbic acid, 80 5-gal. yield envelopes per case (Flavors: cherry, grape, lemon, lime, orange).

Ration Supplement, Beverage Pack, 100 persons per carton, 2 cartons per case.

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<sup>1</sup> Source: Federal Supply Catalog Stock List, FSC Group 89, Subsistence, 1 October 1970

## APPENDIX II -- Comparative Costs of Fruit Beverages

TABLE A.- Orange

	Type	Amt. Fruit Juice	Cost (cents) (per 6 oz. serv. range)
Fresh	Juice	100%	6.6 -- 9.2
Fresh	Juice From concentrate	100%	3.6
Canned	Juice	100%	4.2 -- 9.8
	Juice Drink	50%	NA <sup>1</sup>
	Drink	10%	3.4 -- 5.2
	Flavored Drink	<10%	NA <sup>1</sup>
Frozen Concentrate	Juice 1 + 3	100%	4.1 -- 6.3
	Juice & Synthetic	---	4.6 -- 6.1
Beverage Base, Liquid Conc. 1 + 7			
	Orange Juice & Sweetener	~35%	1.6 -- 1.9
Beverage Base Powder, Natural and Imitation flavors, fortified, Presweetened		---	3.7 -- 5.7
Beverage Base Powder, Synthetic No Sweetener added		---	0.9 <sup>1</sup> -- .99 <sup>2</sup>

<sup>1</sup> Not available

<sup>2</sup> Includes price of sugar at 12 cents per lb.

TABLE B.- Apple

Type	Amt. Fruit Juice	Cost (cents) (per 6 oz. serving range)
Fresh Juice, Bottled	100%	5.1 - 10
Fresh Juice, Canned	100%	4.6 - 10
Cider	100%	4.2 - 6.5
Apple Nectar	~40%	8.8
Apple Drink	10%	4.3
Frozen Concentrate (1 + 3)	100%	4.5 - 5

TABLE C.- Grape

Type	Amt. Fruit Juice	Cost (cents) (per 6 oz. serving range)
Bottled Grape - Concord Grape Juice	100%	8.1 - 11.25
Canned or Bottled Drink	10%	3.6 - 6.6
Frozen Concentrate (1 + 3)	Unknown (not less than 50%)	5.1 - 5.8
Beverage Base, Liquid Conc. (concord Grape Juice & Sweeteners & Acid)	~17%	1.6 - 1.9
Beverage Base Powder Synthetic	None	0.91 - 0.99 <sup>1</sup>

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<sup>1</sup> Includes price of sugar at 12 cents per lb.

TABLE D.- Pineapple

Type	Amt. Fruit Juice	Cost (cents) (per 6 oz. serving range)
Canned Juice	100%	4.2 - 10.2
Pineapple Drink	10%	4.6
Frozen Concentrate (1 + 3)	100%	5.5

**TABLE E.- Grapefruit**

Type	Amt. Fruit Juice	Cost (cents) (per 6 oz. serving range)
Fresh Juice	100%	8.4
Canned Juice	100%	5.9 — 11.5
Drink	10%	NA <sup>1</sup>
Frozen Concentrate (1 + 3)	100%	6.6

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<sup>1</sup> Not available

TABLE F.- Punch

Type	Amt. Fruit Juice <sup>1</sup>	Cost (cents) (per 6 oz. serving range)
Bottled Punch	Unknown	3.4 — 11.5
Frozen Concentrate (1 + 4-1/3)	Unknown	3.7 — 4.6
Frozen Concentrate (1 + 3)	Unknown	2.3

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<sup>1</sup> Contains sugars, ascorbic acid, and artificial color.

TABLE G.- Combinations - (Orange & Pineapple/or Grapefruit)

Type	Amt. Fruit Juices <sup>1</sup>	Cost (cents) (per 6 oz. serving range)
Bottled Juice	100%	5.0 - 7.3
Canned Juice	100%	3.4 - 11.5
Frozen Concentrate (1 + 3)	100%	5.2 - 6.9

<sup>1</sup> May contain sugar.



TABLE H.- Apricot

Type	Amt. Fruit Juice <sup>1</sup>	Cost (cents) (per 6 oz. serving range)
Canned Apricot	Dried Apricot Pulp <sup>1</sup>	6.2 — 12.5
Bottled Apricot Nectar	Similar	6.9

<sup>1</sup> Contains about 8 — 9% sugar on weight basis.

TABLE I.- Prune

Type	Amt. Fruit Juice	Cost (cents) (per 6 oz. serving range)
Canned Juice	not < 18.5% H <sub>2</sub> O sol. Solids extracted dried prunes	9.2 — 11.0
Bottled Juice	not < 18.5% H <sub>2</sub> O sol. Solids extracted dried prunes	7.2 — 19.6

TABLE J.- Cranberry

Type	Amt. Fruit Juice	Cost (cents) (per 6 oz. serving range)
Bottled Cocktail	> 25%	6.2 — 14.8

### APPENDIX III.- REQUIREMENTS BY STATES (AS OF 1968)

STATE	JUICE DRINK	ADE	DRINK	FLAVORED DRINK
California	Orange - 30%	---	---	---
Georgia	---	5% (Lime) 5% (Lemon) 20% Orange	Lemon & Lime: Less than 5% Orange Less than 20%	---
Illinois	30%	---	10%	Less than 10%
Kentucky				
Michigan	50%	25%	10%	Less than 10%
Minnesota	---	6%	6%	---
New Hampshire	Substantial	Orange: 15%	---	---
North Carolina	---	Orange: 15% Lemon: 5%	Grape 15% Orange. 15%	---
North Dakota	---	Orange, Grapefruit Pineapple: 8% Lemon, Lime: 6%		---
Ohio	---	15%	---	---
Pennsylvania	33%	15%	6%	---
Tennessee	50%	25% Lemon, Lime: 10.5%	10% Lemon, Lime: 5%	Less than 10% Lemon, Lime: Less than 5%
Wisconsin	---	---	No Specific Provisions	---

No Specific Provision: Alaska, Arizona, Arkansas, Colorado, Connecticut, Delaware, Florida, Iowa, Indiana, Louisiana, Maine, Massachusetts, Mississippi, Montana, Missouri, Nebraska, New Mexico, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Texas, Vermont, West Virginia.

Pending Adoption or Similar to Proposed Federal Standards: Alabama, District of Columbia, Idaho, Kansas, Maryland, New Hampshire, New Jersey, New York, Puerto Rico, Utah, Virginia, Washington.

The above information should be confirmed before use, due to continuing additions and changes that are made at the various State levels. For more detailed information, consult your local State agency.

#### APPENDIX IV.- Suggested Guide for Interpretation of Nutrient Data <sup>1</sup>

Nutrient	Deficient (<)	Acceptable	Best Juice Source
Niacin (mg/day)	5	15 - 18	Apricot, Orange, or Prune
Riboflavin (mg/day)	0.7	1.2 - 1.4	Orange or Apricot
Thiamine (mg/day)	0.2	0.3 - 0.4	Orange
Ascorbic Acid (mg/day)	10	40 - 60	Orange
Vitamin A (I. U. day)	2000	4500 - 5000	Apricot
Calcium (g/day)	0.3	0.8 - 1.5	Apricot
Phosphorous (g/day)	0.3	0.8 - 1.4	Apricot or Prune
Iron (mg/day)	6.0	10.0 - 18.0	Prune
Protein (g/Kg body wt)	0.5	1.0 - 1.4	None

<sup>1</sup> Based on 1968 Recommended Daily Dietary Allowances of the Food and Nutrition Board, National Research Council

APPENDIX V

DEFINITIONS AND STANDARDS FOR  
DILUTED FRUIT JUICE BASES AND  
DILUTED FRUIT JUICE BEVERAGES

AS ADOPTED BY THE

ASSOCIATION OF FOOD AND DRUG OFFICIALS  
OF THE UNITED STATES

JUNE 20, 1963

WITH AMENDMENTS OF

JUNE 25, 1964

**STATEMENT OF POLICY CONCERNING DEFINITIONS  
AND STANDARDS OF IDENTITY FOR FRUIT JUICE BEVERAGES**

**SECTION I**

1. Among representations in the labeling of fruit juice and flavored and imitation fruit juice beverages which may render such products misbranded are the following:

(a) The word "fresh" used to describe any such product.

(b)(i) In the labeling of nectars, juice-drinks; ades or any concentrate therefore: pictures which misrepresent the product; provided, however; that juice and cut fruit accurately representing the product may be used;

(ii) In the labeling of drinks and punches or any concentrate or base therefore; pictures of juice or fruit other than pictures of flowers; foliage or whole fruit;

(iii) In the labeling of any flavored or imitation drink or any concentrate, base, mix or powder; which when ready to serve contains less than 10% fruit juice by volume: pictures of juice; fruit (whole or cut), flowers or foliage.

(c) Omission of the word "imitation" immediately preceding; any in type of uniform size and prominence as, the common or usual name of the food imitated, if the fruit juice beverage does not meet the minimum applicable provisions of the fruit juice beverage standards.

(d) Reference on the label (other than in the ingredients clause) to the presence of "ascorbic acid" or "Vitamin C" unless the label also bears all labeling required by applicable dietary laws and regulations.

2. Attention is directed to the following:

(a) Single strength or concentrated fruit juice ingredients must comply with all applicable standards of identity.

(b) The label must bear the common or usual name of each ingredient, including water, in descending order of predominance by weight, except that flavorings and colorings may be designated as such.

(c) "Sweeteners" include, and are limited to, sucrose, sugar syrup, corn syrup, and dried glucose syrup.

(d) "True fruit flavors" or "With Other Natural Flavors" include and are limited to essences, extracts, concentrates and oils produced from fruit. If true fruit flavor is used in the finished beverage, the label shall bear the common or usual name of the flavor, such as "orange oil", "grape concentrate", or "raspberry essence", or the statement "true fruit flavor" or "natural flavor", or with other natural flavors.

(e) "Artificial flavors" include but are not limited to extracts from buds, bark, blossoms and leaves. If the natural flavor predominates but is supported by an artificial flavor, the words "artificial flavor" or an equivalent statement shall be included in the ingredients clause. If the artificial flavor predominates, the words "artificial flavor" or an equivalent statement shall be included in the common or usual name of the beverage.

(f) If the product contains artificial color, the ingredient clause must include the statement, "artificial color" or an equivalent statement. When B-carotene, apo-carotenal or other carotenoids having vitamin A activity are used as colorings, an appropriate label claim for the vitamin A may be made.

(g) "Preservatives"; include only those preservatives generally recognized as safe or permitted by regulations under Section 409 of the Federal Food, Drug and Cosmetic Act. If the product contains a preservative, the ingredient clause must include the words "— — — — —, a preservative" or an equivalent statement, the blank to be filled with the name of the preservative used.

(h) "Artificial sweeteners" include cyclamic acid (out now), and its harmless salts and saccharin and its harmless salts. Artificially sweetened products which conform to the standards set forth herein except that the "artificial sweeteners" listed herein are employed in lieu of the "sweeteners" listed in paragraph 2(c) above, shall not be labeled "imitation" if they are offered as dietary products and are properly labeled as such.

3. When concentrated fruit juice is used in the preparation of diluted fruit juice beverages, the equivalent quantity of natural strength juice which such concentrate represents shall be the quantity of concentrate used together with the amount of water needed to dilute the soluble solids to the concentration for single strength juice for each fruit given in the following table:

Name of Fruit	Average Concentration of
	Single Strength Juice- Degrees Brix
Apple	13.3
Apricot	14.3
Blackberry	10.0
Boysenberry	10.0

Name of Fruit	Average Concentration of Single Strength Juice-- Degrees Brix
Cherry	14.3
Grape (Labrusca Varieties)	14.3
Grape (Vitifera)	22.0
Guava	7.7
Loganberry	10.5
Mango	---
Nectarine	---
Orange	11.8
Passion Fruit	---
Papaya	---
Peach	11.8
Pear	---
Pineapple	14.3
Plum	14.3
Lemon	---
Lime	---
	(5.7 grams of citric acid per 100 ml. calc. as anhydrous citric acid)
Cranberry	6.5

4. Any concentrate, base, mix, powder or similar product, which when reconstituted in accordance with directions, results in a finished product complying with the provisions of a definition and standard of identity for nectar, juice-drink, ade, punch, drink, or flavored drink, shall be labeled "concentrate (or 'Base') for — — — —", or equivalent statement, the blank to be filled with the name of the appropriate standardized fruit juice beverage. All letters in the name of the product shall appear in the same size, style, and color of type and on the same background. Any such concentrate, base, mix, powder or similar product, which, when reconstituted in accordance with directions, does not result in a finished product complying with one of the definitions and standards of identity for a fruit juice beverage shall be labeled "imitation — — — —", the blank to be filled in with the name of the product imitated in the same size, style, and color of type and on the same background as the word "imitation."

#### DEFINITIONS AND STANDARDS OF IDENTITY FOR FRUIT JUICE BEVERAGES

##### 1. NECTAR

(a) Nectar is the pulpy, unclarified food prepared by blending pureed fruit pulp or whole fruit or both, with water and fruit juice (natural strength, reconstituted, or concentrated, or both). It may be heat-treated, chilled, canned, or frozen. Except orange nectar (which shall have a distinguishing pulpy consistency, and not less than 0.5145 lb.

of orange juice soluble solids per gallon), the consistency of the finished product shall be not less than 30 seconds as determined by the method described in "Consistency Measurement of Fruit Nectars and Fruit Juice Products", p. 411, Vol. 42, No. 2, 1959 of the Journal of the Association of Official Agricultural Chemists.

(b)(i) If the food contains only one fruit ingredient, the fruit content shall be not less than the following percentage by weight of the finished product:

Name of Fruits

Apple	40%	Orange	50%
Apricot	35%	Passion Fruit	40%
Blackberry	40%	Papaya	33-1/3%
Boysenberry	40%	Peach	40%
Cherry	40%	Pear	40%
Guava	25%	Pineapple	40%
Loganberry	40%	Rum	40%
Mango	40%	Other fruits	40%
Nectarine	40%		

(ii) If the food contains two or more fruit ingredients, the percentage by weight of each fruit ingredient in the finished food shall be not less than the percentage specified in (b)(i) multiplied by the percentage which such fruit ingredient bears to the total weight of the fruit ingredients.

(c) Nectar may contain any edible organic acid, ascorbic acid (vitamin C) (but no more than 40 mg in each 100 ml of the finished beverage may be declared on the label); sweeteners true fruit flavors derived from the fruit named, and preservatives.

(d) The name of the food is "fruit nectar" or "— — — — nectar", the blank to be filled with the name of fruit or fruits used in order of predominance; provided, however, that if the food contains two or more fruit ingredients, the name of the fruit ingredient which constitutes less than 10% of the weight of the fruit ingredients present shall not be included in the name of the food.

## 2. JUICE DRINK

(a) Juice-drink is the food prepared by blending natural strength fruit juice, concentrated fruit juice or both, from one or more fruits, with water. It may be heat-treated, chilled, canned or frozen. The fruit juice or reconstituted fruit juice content shall be not less than 50% of the volume of the finished product, except cranberry-based juice drinks where the volume of cranberry juice may be calculated at twice its volume



in determining if the product satisfied the 50% volume requirement. Orange juice drink shall contain not less than 0.5145 lb. of orange juice soluble solids (11.8° Brix basis) per gallon. (See Statement of Policy, Para. 3).

(b) Juice drink may contain any edible organic acid, ascorbic acid (vitamin C) (but no more than 40 mg in each 100 ml of the finished beverage may be declared on the label), sweeteners, true fruit flavors derived from the fruit named, and preservatives.

(c) The name of the food is "fruit Juice-drink" or "— — — — — juice-drink", the blank to be filled with the name of the fruit or fruits used in order of predominance; provided, however, that if the food contains two or more fruit ingredients, any fruit ingredient which constitutes less than 10% by volume of the total juice present on a single strength basis shall not be included in the name of the food.

### 3. ADE

(a) Ade is the food prepared by blending natural strength fruit juice, concentrated fruit juice or both, with water. It may be heat-treated, chilled, canned or frozen. The fruit juice or reconstituted fruit juice content shall not be less than 25% of the volume of the finished product; provided, however, that in the case of cranberry ade, lemonade, limeade or lemon-limeade, the natural strength fruit juice or reconstituted fruit juice content shall not be less than 12.3% of the volume of the finished product; and provided further that orangeade shall contain not less than 0.257 lb. of orange juice soluble solids (11.8° Brix basis) per gallon. (See Statement of Policy, Para. 3);

(b) Ade may contain any edible organic acid, ascorbic acid (vitamin C) (but no more than 40 mg. in each 100 ml of the finished beverage may be declared on the label); sweeteners, true fruit flavors derived from the fruit named, and preservatives, except that lemonade, limeade, and lemon-limeade may not contain any added edible organic acid other than lemon juice or lime juice. Colorings which do not simulate the color of the natural fruit juice present may be used. If the product is colored with one or more fruit juices, it shall be labeled "Colored with Fruit Juice".

(c) The name of the food is "fruit ade" or "— — — — — ade", the blank to be filled with the name of the fruit or fruits used in order of predominance; provided, however, that if the food contains two or more fruit ingredients, any fruit ingredient which constitutes less than 10% by volume of the total juice present on a single strength basis shall not be included in the name of the food.

### 4. PUNCH

(a) Punch is the food prepared by blending two or more natural strength fruit juices, concentrated fruit juices, or both, with water. It may be heat-treated, chilled, canned or frozen. The fruit content shall be not less than 10% of the volume of the finished product.

(b) Punch may contain any edible organic acid, ascorbic acid (vitamin C) (but no more than 40 mg in each 100 ml of the finished beverage may be declared on the label); sweeteners, true fruit flavors, colorings, stabilizers, emulsifiers, buffering salts and preservatives.

(c) The name of the food is "fruit punch" or "— — — — — punch", the blank to be filled with the name of the fruit or fruits used in order of predominance or with any term recognized as descriptive of the product; provided, however, that if the food contains two or more fruit ingredients, any fruit ingredient which constitutes less than 10% by volume of the total juice present on a single strength basis shall not be included in the name of the food.

#### 5. DRINK

(a) Drink is the food prepared by blending natural strength fruit juice, concentrated fruit juice or both, with water. It may be heat-treated, chilled, canned or frozen. The fruit content shall be not less than 10% of the volume of the finished product; provided, however, that in the case of cranberry drink, lemon drink, lime drink or lemon-lime drink, the natural strength fruit juice content shall be not less than 6.0% of the volume of the finished product, (.342 grams anhydrous citric acid per 100 ml derived solely from lemon and lime juice); and provided further that orange drink shall contain not less than 0.103 lb. of orange juice soluble solids (11.8° Brix Basis) per gallon. (See Statement of Policy, Para. 3).

(b) Drink may contain any edible organic acid, ascorbic acid (vitamin C) (but no more than 40 mg in each 100 ml of the finished beverage may be declared on the label), sweeteners, true fruit flavors, colorings, stabilizers, emulsifiers, buffering salts and preservatives.

(c) The name of the food is "fruit drink" or "— — — — — drink", the blank to be filled with the name of the fruit or fruits used in order of predominance; provided, however, that if the food contains two or more fruit ingredients, any fruit ingredient which constitutes less than 10% by volume of the total juice present on a single strength basis shall not be included in the name of the food.

#### 6. FLAVORED DRINK

(a) Flavored drink is the food prepared by blending natural strength fruit juice, concentrated fruit juice or both, with water. It may be heat-treated, chilled, canned or frozen. The fruit content is less than 10% of the volume of the finished product; provided, however, that in the case of cranberry flavored drink, lemon flavored drink, lime flavored drink, or lemon-lime flavored drink, the natural strength fruit juice content is less than 6% of the volume of the finished product. (See Statement of Policy, Para. 3).

(b) Flavored drink may contain any edible organic acid, ascorbic acid (vitamin C) (but no more than 40 mg in each 100 ml of the finished beverage may be declared on the label), sweeteners, true fruit flavors, colorings, stabilizers, emulsifiers, buffering salts and preservatives.

(c) The name of the food is "flavored drink" or "— — — — — flavored drink", the blank to be filled with the name of the fruit or fruits used in order of predominance provided, however, that if the food contains two or more fruit ingredients, any fruit ingredient which constitutes less than 10% by volume of the total juice present on a single strength basis shall not be included in the name of the food.